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## On Phase Diagram of Ising Model on the Cayley Tree with Restricted Competing Interactions up to the Third-Nearest-Neighbor Generation

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### Abstract

We study the phase diagram of the Ising model on Cayley tree with competing the first-, second-, and third-nearest-neighbor interactions. We generalize the approach used by Vannimenus for the Ising model with only first-and second-nearest neighbor interactions. The extension of the anisotropic next-nearest-neighbor Ising (ANNNI) model to include third-nearest-neighbor interactions (A3NNI model) has been proposed by Yamada and Hamaya in an attempt to explain the phase diagram structure of several ferroelectric systems of the type A2BX4. We show that the inclusion of the third-nearest-neighbor interactions is essential for the presence of a periodic + + + - - -antiphase < 3>. In addition, we discuss similarity, in comparison with the phase diagram of the Vannimenus's approach with competing first-and second-nearest-neighbors. Finally, in the modulated phase was studied in detail where narrow commensurate steps between incommensurate regions appeared when investigating the Lyapunov exponent associated with trajectory of the system.

### Keywords

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